Serial #90001 = F-90-3
#90003 = F-90-4

CRUISE REPORT

R/V FARNELLA F-90-3 and F-90-4

25 March - 26 April, 1990

Mississippi Fan Ground Truth Program

by

David Twichell
U.S. Geological Survey
Woods Hole, MA

CRUISE REPORT

Vessel:

R/V FARNELLA

Area of Operation:

Mississippi Fan and Base of the Florida Escarpment in the eastern Gulf of Mexico - mostly in the area 26°-27° N. and 84.5°-87° W. although coring on the second leg of the cruise was also done in the area 25°-25.5° N. and 84.5°-85° W.

Dates:

F-90-3 25 March - 8 April, 1990
Tampa, FL to Tampa, FL

F-90-4 12 April - 26 April, 1990
Tampa, FL to Tampa, FL

Personnel:

F-90-3 J. Cannon, Captain
D. Twichell, USGS - AMG - Cochief Scientist
W. Schwab, USGS - AMG - Cochief Scientist
W. Danforth, USGS - AMG
B. Irwin, USGS - AMG
D. Lubinski, USGS - AMG
T. O'Brien, USGS - AMG
D. Mason, USGS - AMG
L. Bader, USGS - PMG
M. Hamer, USGS - PMG
L. Kooker, USGS - PMG
N. Kenyon, IOS
T. Crook, WHOI - DSL
T. Dettweiler, US Navy
M. Williamson, IDSS

K. Redman, IDSS
N. Lesnikowski, IDSS
J. McDowell, IDSS

F-90-4

W. Schwab, USGS - AMG - Cochief Scientist
D. Twichell, USGS - AMG - Cochief Scientist
W. Danforth, USGS - AMG
B. Irwin, USGS - AMG
D. Lubinski, USGS - AMG
T. O'Brien, USGS - AMG
R. Rendigs, USGS - AMG
W. Winters, USGS - AMG
L. Bader, USGS - PMG
J. Barber, USGS - PMG
H. Lee, USGS - PMG
H. Nelson, USGS - PMG
J. Vaughan, USGS - PMG
N. Kenyon, IOS
T. Crook, WHOI - DSL
C. Paull, UNC
W. Ussler, UNC

Equipment:

F-90-3

SeaMARC I and 4.5-kHz profiler - IDSS
QMIPS data acquisition system - USGS
Masscomp sidescan sonar processing system - USGS
3.5-kHz surface towed subbottom profiler - USGS
Loran C and GPS navigation system - USGS
Benthos acoustic navigation system - WHOI, DSL

F-90-4

Piston corer - USGS
3.5-kHz surface towed subbottom profiler - USGS
Loran C and GPS navigation system - USGS
Benthos acoustic navigation system - WHOI, DSL
Gas chromatograph - UNC
Velocimeter - USGS

Objective:

FARNELLA cruises F-90-3 and F-90-3 were conducted in the Eastern Gulf of Mexico to study recent sedimentary processes on the Mississippi Fan and along the base of the Florida Escarpment. GLORIA images in concert with 3.5 kHz profiles had been used to divide the fan's surface into several depositional lobes. This ground-truth program focused on one of these depositional lobes to further our understanding of (1) the acoustic properties of the sediments that are creating the different backscatter patterns revealed on the GLORIA images, (2) the mechanics of transport and deposition of these lobes, (3) the sedimentology of these deposits, and (4) hopefully some insight into their timing of deposition. In addition to the work on the Mississippi Fan, a second objective was to collect cores from plunge pools along the base of the Florida Escarpment to define the sedimentology of these deposits were sample pore water from the cores to measure Chloride, Sulfate, Methane, and Sulfide. These chemical analyses are intended to shed light on the occurence of dense brines seeping out of the Florida Platform.

Narrative:

This ground-truth program was extremely successful, although things started a bit slowly at the beginning of the first leg. A gravity line was run on the way out from Tampa for Bill Dillon for the Florida transect project, and once we were at our first survey area a brief echo sounder survey was conducted, and then transponders were deployed and surveyed in (transponder locations listed in Table I). For the first several days we had problems with the SeaMARC I side-scan sonar system, but after the bugs were ironed out the system worked almost flawlessly, and we obtained approximately 10 days of excellent quality SeaMARC I imagery along the track lines shown in Figure 1. Our main problem, once the bugs were out of the system, was the Loop Current which was highly variable in direction and had speeds reaching 3.5 knots. This current made towing the SeaMARC vehicle at 2-3 knots within 500 m of the bottom extremly challenging for much of the cruise.

The first, and westernmost area focused on where the depositional lobe breached the levee of the main channel. This survey covered approximately 925 km^2 and covered the transition from the main channel to the beginning of the distributary channel that extends off to the east.

The distributary channel could only be traced to within about 5 km of the main channel, and a mottled area separates the two channels. Mass wasting seemed to be common on the flanks of the levees of the main channel, and we think that the complicated transition from the main channel to the distributary channel was due to this area being masked by mass wasting deposits. The distributary channel was followed eastward to the second survey area which was at the distal end of this channel system and covered an area of approximately 2200 km^2. The distributary channel did not bifurcate until within a few 10s of kilometers of its end. Several bifurcations were observed, and at the end of each were areas of high acoustic backscatter that had abrupt edges with the surrounding acoustically low backscatter sea floor. The area that was surveyed north of the distal part of the distributary channel shows that this channel shifted laterally during its development. Other channel segments with high backscatter areas at their distal ends were observed that are now isolated from the most recently active channel.

During the second leg of the cruise 67 cores were collected; 20 in the western area, 9 along the base of the Florida Escarpment, and 38 in the area of the eastern SeaMARC survey. A listing of core locations, lengths, and intended uses is given in Table II. Cores were split, described, and sampled at sea except for those that were stored for future geotechnical analyses. Many of the cores were not very long (see Table II), and in many cases the reason for this was the unexpected sandy nature of the bottom sediments. Some of the short cores, particularly at the beginning of the cruise, were the result of not having the trip wire or free-fall length set correctly.

Cores from the western study area recovered mostly muddy sediments (although there were occasional silt beds interspersed in the mud) from the channel floors and levees of both the main and distributary channels. The cores visually were homogeneous for the most part although some evidence of mass wasting was seen and a few turbidite beds were present.

In the western area, the high backscatter areas at the ends of the distributary channels and the channel floors had layers of poorly sorted fine sand in them while the low backacatter regions consistently recovered muds with organic-rich bands in them. In general, the stratigraphy in the cores from the high-backscatter areas revealed a basal unit comprising a single layer or several sand layers that were several

10s of cm to at least 1 m in thickness. In a few instances, though, the cores penetrated through the sand unit and recovered mud similar to that found in the surrounding low-backscatter areas. Overlying the sand layers often was a mud unit with different colored mud clasts in it, and at the top of all cores was a muddy to foram sand rich layer that was about 30 cm thick. The origin of these deposits is unclear. Some of the sand units were graded and appeared to be turbidites, but others were massive suggesting perhaps a different mechanism of deposition. The presence of clasts in some of the muddy units suggests that they may be of debris flow origin.

The nine cores collected along the base of the Florida Escarpment were collected to look at the interplay of carbonate sediments shed off the Florida Platform and the Mississippi Fan sediments, and also to look at the pore water chemistry of these sediments. Carbonate debris flows were cored that were interbedded with fan muds. Water samples were taken for chemical analyses to be completed back at the University of North Carolina.

Tabulated Information:

A. Days at sea:

F-90-3	15
F-90-4	14

B. Amount of data collected

System	Amount of data collected
SeaMARC	3466 km^2
4.5 kHz	950 km
3.5 kHz	2280 km
Piston cores	55
Gravity cores	12

TABLE I

Locations of transponders for the two nets deployed during F-90-3 and F-90-4 in the Gulf of Mexico

WEST NET

Origin 26° 10' N. 86° 30' w

Transponder	Freq	Code	X(east)	Y(north)	Z(depth)	RMS	Latitude	Longitude
A 34482	9.0/9.5	C	13904.1	8946.2	2952.8	14.66	26° 14.845	86° 21.656
B 42617	9.0/10.0	E	18030.8	8174.7	2998.3	4.72	26° 14.427	86° 19.179
C 34480	9.0/10.5	D	16773.9	12256.2	3006.3	5.68	26° 16.638	86° 19.993

Average sound velocity = 1500.00 m/sec

Polywog at 20 m - 3 knots for survey points
Data files used for survey crunch: WestA1.dat, West B2.dat, West C2.dat

	AB	AC	BC
Baseline length (m)	4198.2	4380.9	4270.6
Baseline bearing (deg)	100.6	40.9	342.9

EAST NET

Origin at 26° 40' N. 85° 15' w

Transponder	Freq	Code	X(east)	Y(north)	Z(depth)	RMS	Latitude	Longitude
A 44381	9.0/9.5	C	5711.4	6894.6	3188.9	3.78	26° 43.734	85° 11.558
B 44365	9.0/10.5	D	7985.0	3083.7	3230.4	3.87	26° 41.670	85° 10.187
C 35855	9.0/11.0	B	10273.1	6900.3	3193.0	3.48	26° 43.737	85° 08.808

Average sound velocity = 1504.93 m/sec

Polywog at 65 m - stopped for survey points
Data files used for survey crunch: EastA1.dat, EastB3.dat, East C2.dat

	AB	AC	BC
Baseline lengths (M)	4437.6	4561.7	4449.9
Baseline bearings (deg.)	149.2	89.9	30.9

TABLE II

Locations of cores collected during F-90-4 in the Gulf of Mexico

CORE NUMBER	LATITUDE	LONGITUDE	WATER DEPTH (m)	CORE LENGTH (cm)
GC-01	26°13.8700'n	86°26.3400'w	3095	155
PC-02	26°13.9700'n	86°26.2000'w	3095	294
PC-03	26°13.8600'n	86°26.1600'w	3095	178
PC-04	26°14.7300'n	86°26.1200'w	3060	326
PC-05	26°14.7300'n	86°26.1500'w	3060	Geotech
PC-06	26°14.7200'n	86°26.1200'w	3060	Geotech
PC-07	26°14.9900'n	86°26.1100'w	3063	082
PC-08	26°15.0100'n	86°26.0900'w	3063	
PC-09	26°16.8100'n	86°24.4200'w	3105	232
PC-10	26°13.2200'n	86°26.7500'w	3072	460
PC-11	26°13.6100'n	86°22.0800'w	3090	144
PC-12	26°17.8261'n	86°20.5142'w	3140	330
PC-13	26°17.8551'n	86°20.4618'w	3140	Geotech
PC-14	26°18.4718'n	86°19.6730'w	3140	155
PC-15	26°18.4792'n	86°19.7768'w	3140	Geotech
PC-16	26°20.4700'n	86°13.9600'w	3165	318
PC-17	26°15.6963'n	86°16.8675'w	3122	173
PC-18	26°15.1800'n	86°16.8693'w	3125	083
PC-19	26°14.4297'n	86°16.6088'w	3118	533
PC-20	26°15.1398'n	86°16.8975'w	3127	170
PC-21	25°19.4800'n	84°44.9500'w	3353	295
GC-22	25°20.7000'n	84°42.7100'w	3410	414
PC-23	25°20.6300'n	84°42.7200'w	3410	586
PC-24	25°17.7800'n	84°40.4100'w	3375	556
PC-25	25°16.4100'n	84°43.4800'w	3360	374
PC-26	25°17.6400'n	84°41.6000'w	3250	234
PC-27	25°20.2700'n	84°43.6500'w	3332	320
PC-28	26°43.0449'n	85°10.4756'w	3283	235
PC-29	26°42.7330'n	85°09.5086'w	3283	366
PC-30	26°42.4115'n	85°09.0121'w	3283	435
PC-31	26°41.7797'n	85°08.2940'w	3283	549

PC-32	26°41.4836'n	85°07.5715'w	3283	655
PC-33	26°41.4802'n	85°07.6022'w	3285	Geotech
PC-34	26°42.1879'n	85°07.5389'w	3285	570
PC-35	26°42.1956'n	85°07.5283'w	3285	Geotech
PC-36	26°42.0989'n	85°08.9338'w	3285	526
PC-37	26°41.3955'n	85°10.6190'w	3283	125
PC-38	26°42.4969'n	85°11.2330'w	3283	212
PC-39	26°42.7116'n	85°11.2842'w	3283	000
PC-40	26°42.7203'n	85°11.3107'w	3283	000
PC-41	26°43.4336'n	85°12.5323'w	3280	305
PC-42	26°43.6998'n	85°13.2132'w	3280	092
PC-43	26°44.3136'n	85°08.5144'w	3283	039
GC-44	26°43.3996'n	85°09.1476'w	3283	178
PC-45	26°42.5051'n	85°11.2481'w	3283	Geotech
PC-46	26°40.7559'n	85°10.6225'w	3282	000
PC-47	26°40.6578'n	85°10.4194'w	3282	211
GC-48	26°40.8453'n	85°10.4148'w	3282	168
GC-49	26°42.4967'n	85°11.2228'w	3283	Geotech
GC-50	26°42.7511'n	85°11.0057'w	3283	108
GC-51	26°44.2605'n	85°08.3799'w	3283	071
PC-52	26°28.8600'n	85°05.0400'w	3294	274
PC-53	26°27.8500'n	85°04.7000'w	3293	519
PC-54	26°25.7900'n	85°03.6500'w	3295	644
PC-55	26°24.8700'n	85°03.5300'w	3295	621
PC-56	26°23.7100'n	85°03.0300'w	3295	200
GC-57	26°30.8400'n	85°16.1100'w	3280	038
PC-58	26°29.7000'n	85°22.0600'w	3266	000
GC-59	26°29.7900'n	85°22.0100'w	3266	023
GC-60	26°30.3100'n	85°22.2700'w	3267	091
GC-61	26°31.1200'n	85°22.5300'w	3265	125
GC-62	26°30.4700'n	85°14.9900'w	3278	000
PC-63	26°29.7200'n	85°12.8000'w	3285	043
PC-64	26°26.6900'n	85°04.6100'w	3295	023
PC-65	26°26.7800'n	85°04.2000'w	3295	124
PC-66	26°02.8800'n	84°54.9000'w	3306	340
PC-67	26°05.4800'n	84°54.9800'w	3307	053

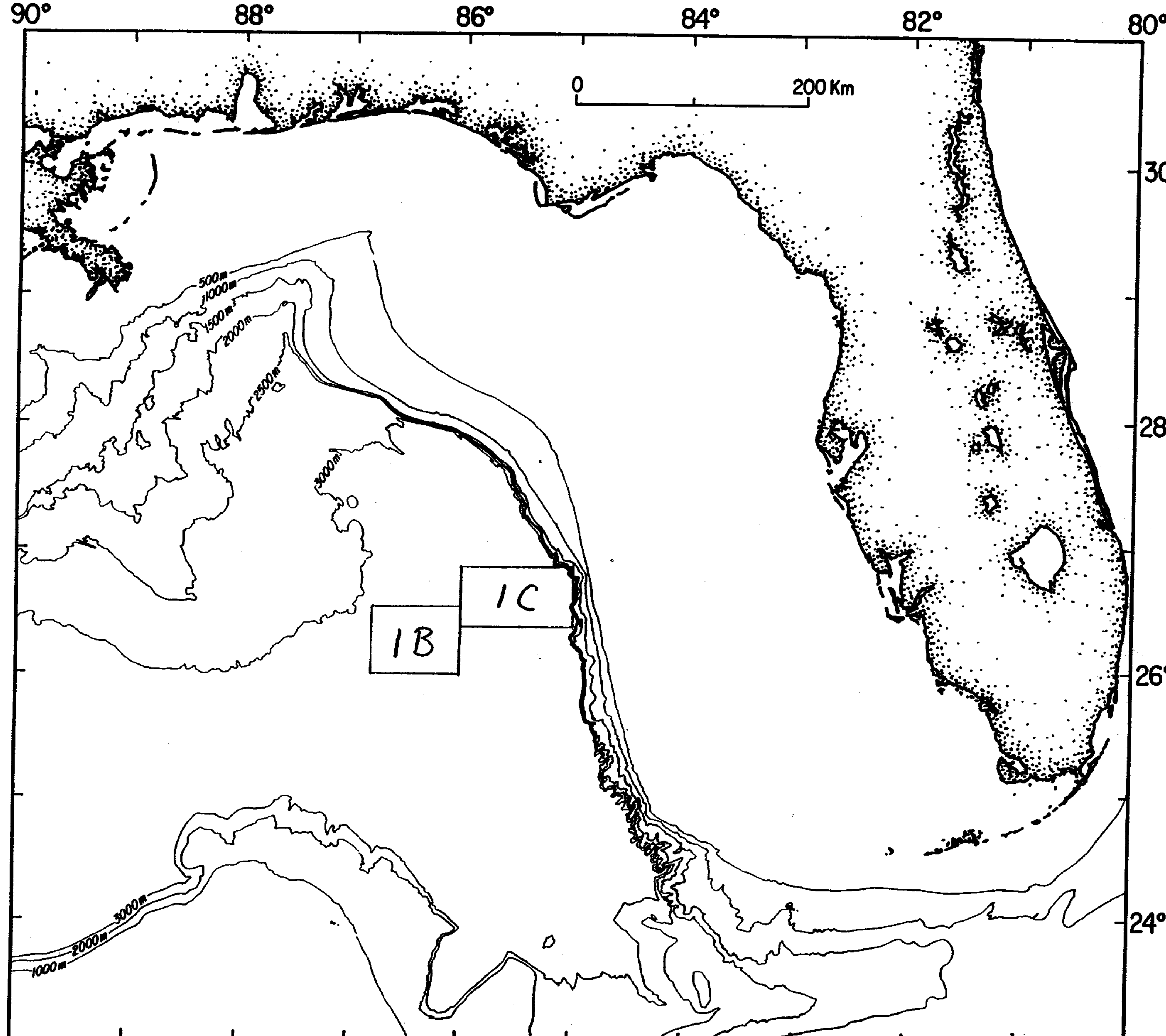
90°
88°
86°
84°
82°
80°
30°
28°
26°
24°
0
200 Km
500m
1000m
1500m
2000m
2500m
3000m
1C
1B
3000m
2000m
1000m

Figure 1A

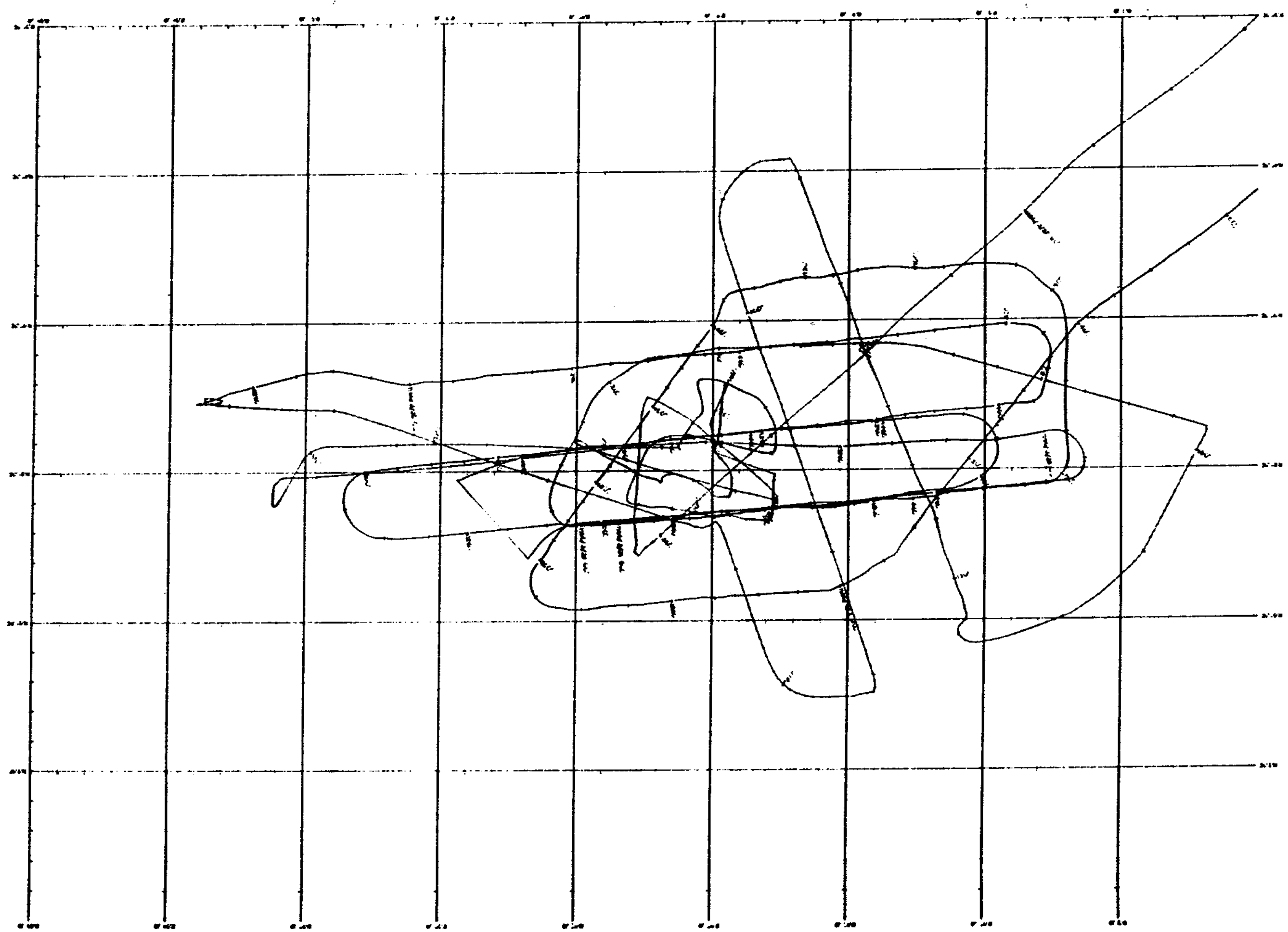

Figure 1B

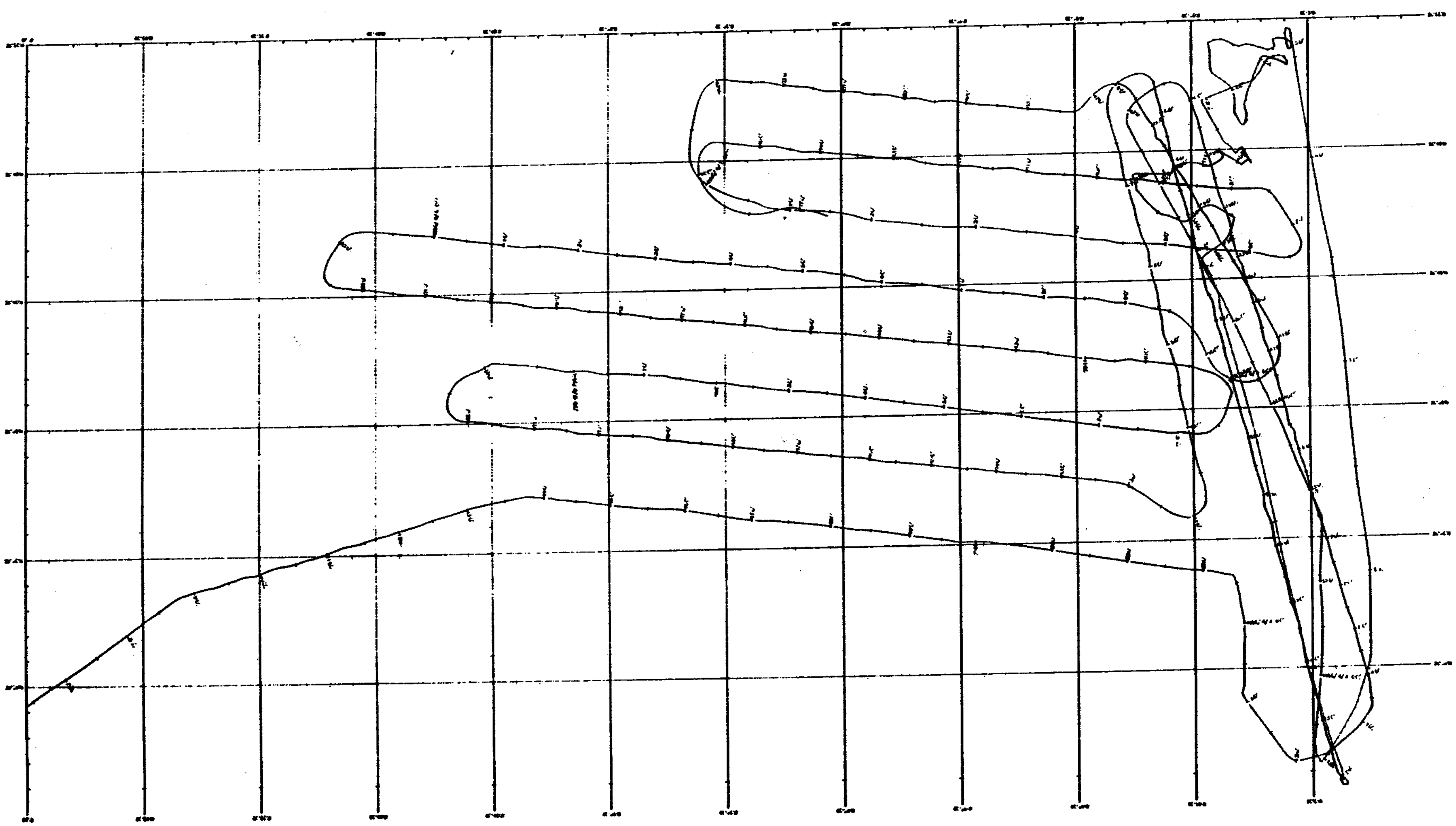

Figure 1C